instruction manual

INSTRUCTION MANUAL

Model 5580
REFERENCE GENERATOR

PROPERTY OF DEPT. 066
CENTRAL RECORDS

Beckman®

Berkeley Division

INSTRUCTION MANUAL

Model 5580
REFERENCE GENERATOR

Lot 2 and above
Serial 111 and above

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CENTRAL RECORDS

BERKELEY division of
Beckman Instruments, Inc.

Richmond 3, California
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Model 5580 Reference Generator
with Converter Unit

DESCRIPTION

The Model 5580 Reference Generator, together with its plug-in converter units, is designed to extend the frequency range of the Berkeley Model 5570 or Model 5571 Frequency Meter. Used together the instruments will measure frequencies ranging from 0 to 515MC.

The Model 5580 Reference Generator consists of three basic parts:

1. A harmonic amplifier which multiplies the 1 MC signal obtained from Frequency Meter to 10 and 30MC for the purpose of driving the various converter units.

2. A broadband amplifier which amplifies the output of the converter units to the proper level to drive the Frequency Meter.

3. A power supply which provides power for the Model 5580 and the various converter units.

General Specifications

Range	42 to 515MC when used with a complete set of plug-in units.
Accuracy	± 1 part in 10^7 (crystal accuracy) ± 1 count.
Power requirements	117 volts ±10%, 50 to 60 cps, 80 watts.
Output level	0.1 volts rms, into 100 ohms.

OPERATION

Installation

The Model 5580 requires no special installation procedure. It may be operated in any well-ventilated location. The unit is designed to operate from an a-c source of 117 volts, 50 to 60 cps, at a power rating of 80 watts.

Control and Connector Functions

Front Panel

POWER switch	Connects instrument to line power.
GAIN control	Adjusts gain of broadband amplifier.
OUTPUT jack	Connects output to Model 5570 or Model 5571.
AMPL INPUT jack	Permits use of the broadband amplifier preceding the Model 5570 when measuring low level signals in the 2 to 35MC range.
Jack J104	Receptacle for plug-in units.

Chassis Rear

Connector J103	Connects Model 5580 to line power.
1MC INPUT jack	Connects to the 1MC oscillator signal produced by the Model 5570or the Model 5571.

Operating Procedure

To make a frequency measurement set up the Model 5580 as follows:

1. Connect the power cord to a 117 volt, 50-60 cps source.
2. When using the Model 5570 connect the 1MC INPUT jack (chassis rear) to the 1MC INPUT jack (J102) on the Model

5570 Indicator chassis. Use the "T" connector provided to maintain the connection between J102 and the 1MC OUTPUT jack (J401) on the Heterodyne Unit chassis.

When using the Model 5571 connect the 1 MC INPUT jack to the FREQUENCY jack on the Model 5571 upper chassis rear. Use the "T" connector to maintain the connection between the FREQUENCY jack and the 1 MC OUTPUT jack on the lower chassis rear.

3. Connect the OUTPUT jack of the Model 5580 to the input of the Heterodyne unit.

4. Insert the desired converter unit. (If the converter unit is the Model 5581/4, disregard the rest of the instructions on this page. Proceed as described under "OPERATION" in the Model 5581/4 appendix to this manual.)

5. Turn on the POWER switch and allow the set to warm up a few minutes.

6. Connect the signal to be measured to the INPUT jack of the converter unit. (The input level should lie between 0.1 and 0.25 volts into 50 ohms.)

7. Adjust the GAIN control unitl the meter reads at least 65μamperes.

Step 7 completes the Reference Generator connections and adjustments. Proceed to make a frequency measurement with the Frequency Meter in the usual way. To obtain the frequency of the signal being measured add the basic frequency of the converter unit used to the reading on the Frequency Meter. For example, if the 5581/45 converter unit is used and a reading of 18.515920MC appears on the Frequency Meter, the unknown frequency equals 18.515920 plus 450MC or 468.515920MC.

CIRCUIT DESCRIPTION

Figure 1 is a block diagram of the Model 5580 showing the way it functions with the plug-in unit and the basic frequency meter.

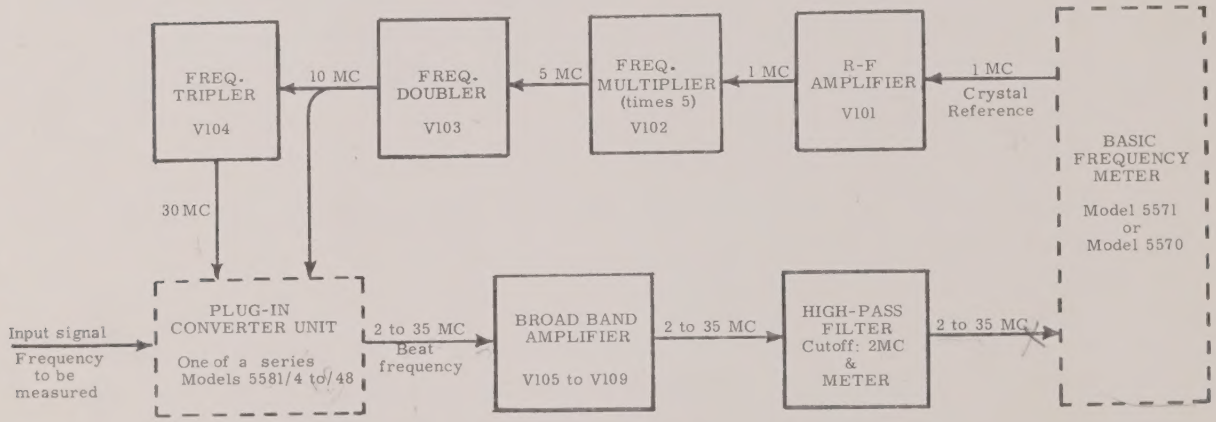


Figure 1 Block Diagram

Multiplier Circuits. (Harmonic Amplifiers)

The first stage (V101) receives the 1 MC reference signal from the Frequency Meter and amplifies it to the proper level to drive V102 as a five-times multiplier. The plate of V101 is tuned to 1 MC. The plate of V102 and the grid of the next stage (V103) are tuned to 5 MC by the resonant circuits L102, C108 and L103, C109. The resonant circuits are coupled loosely by a small capacitor (C110). V103 is a frequency doubler. Its plate and the grid of the next stage (V104) are tuned to 10 MC by L104, C114 and L105, C115. The 10 MC signal is picked up by L106, a one-turn link wound around L105, and conducted to the Converter Unit jack (J104) for those units which require that reference frequency.

V104 is a frequency tripler. Its plate is tuned to 30 MC by L107, C120 and coupled through C122 to another resonant circuit (L108, C121 also tuned to 30 MC. The 30 MC signal is picked up by L109, a one-turn link wound around L108, and conducted to the Converter Unit jack for units which require that reference frequency.

The plate supply is connected to Pin 3 of J104. Plate voltage for the converter unit is obtained at this pin. The converter unit plug fitting J104 is internally connected so that plate voltage is applied only to those multiplier stages which are in use. When no converter unit is in the Reference Generator receptacle, Pins 1 and 2 of J104 are disconnected from the source of plate voltage and only the broadband amplifier (V106 to V109) is operative. A converter unit using a 10MC input reference signal contains a plug fitting J104 in which Pins 2 and 3 are jumpered. When such a unit is plugged-in, plate voltage is delivered to V101, V102 and V103, the stages producing the 10 MC signal. A converter unit using a 30MC input reference signal contains a plug with Pin 3 jumpered to Pin 2 and Pin 2 to Pin 1. When such a unit is plugged-in, plate voltage is also delivered to V104, the stage generating the 30MC signal.

Broadband Amplifier

The broadband amplifier (V105 to V109) amplifies the beat frequency produced by the plug-in unit to the input signal level required by the basic frequency meter. The amplifier response is flat within ±1.5 db over the 2 to 35 MC range of beat frequencies used. It has a gain of about 30 db.

The first four stages are frequency compensated amplifiers. The plate circuit of each is series-shunt peaked to extend the frequency

range to 35 MC. The series peaking coils (L111, 112, 113,&114) peak frequencies at the high end of the range and cut off the response just beyond 35 MC. The shunt peaking coils (L110, 112, 114 & 116) peak the mid range. The plate load resistors (R119, R124, R129 & R134) determine the response at the low end of the frequency range.

The last stage (V109) drives the low impedance output cable. A high pass filter and an output meter are connected between this stage and the OUTPUT jack. The filter (L118, L119) cuts off frequencies below 2 MC which might otherwise cause extraneous counts on the basic frequency meter. The output meter reads 65 μamperes when the output is 0.1 volts.

Power Supply

The power supply is a conventional transformer -- rectifier--filter arrangement. It supplies plate and filament power for both the Model 5580 and the plug-in converter unit. A line filter (Z101) has been inserted in the power line to reduce radiation from the instrument and minimize stray pick-up from the power line.

ALIGNMENT AND PERFORMANCE CHECKS

All coils have been adjusted at the factory and should not require readjustment because of tube changes or normal aging of components. The alignment and test procedure below is provided mainly to help you locate the source of any trouble which may occur. The following equipment is required:

1. A VTVM with a diode probe
2. A sweep signal generator which will sweep the band from 2 to 40 MC
3. A high gain d-c coupled oscilloscope.
4. A calibrated standard signal generator
5. A microammeter (200 μa full scale)

NOTE: If you do not have a sweep signal generator and a d-c oscilloscope, you may align the broadband amplifier using only a standard calibrated signal generator. Follow the procedure outlined below substituting the standard signal generator for the sweep generator and hand plotting the frequency response curves as required. Output amplitude may be read on the built-in microammeter.

Unless otherwise specified, maintain these conditions throughout the alignment procedure:

115 volt line input
Power on
GAIN control in extreme clockwise position
A 100 ohm resistor across the OUTPUT jack

Broadband Amplifier Alignment

The purpose of this alignment is to achieve maximum gain and a flat frequency response over the range of 2 to 35 MC. The four frequency compensated stages are adjusted in order from the latest to the earliest.

1. Loosen the lock nuts on the adjusting screws of L110 thru L117.
2. Connect a 10K resistor in place of the output meter and connect a high-gain d-c oscilloscope across the resistor
3. a. Connect a 100 ohm resistor across the output of the sweep generator and connect the output to the signal grid (pin 1) of V108. Set the sweep generator to sweep 2 to 42 MC.

   The frequency response curve of V108 and the output stage should now appear on the scope.

   b. Connect the output of the calibrated signal generator to the marker input on the sweep generator. Set the output frequency at 35 MC and adjust its level until the "pip" which appears on the response curve is just large enough to be easily seen.

   c. Adjust the slug in L117 until the cut-off point on the response curve is at 35 MC.

   d. Adjust L116 for the flattest over-all frequency response.
4. a. Move the output of the sweep generator to the signal grid (pin 1) of V107.

   The response curve of V107, V108 and the output stage now appears on the scope

   b. Attenuate the outputs of the sweep generator and the marker generator to obtain a satisfactory display on the scope. (Do not attenuate the scope.)

   c. Adjust L115 for a cut-off at 35 MC and L114 for the flattest over-all response.

5. Move the sweep generator output to pin 1 of V106, attenuate the generator outputs further and adjust L113 for cut-off at 35 MC and L112 for the flattest over-all response.

6. a. Remove the 100 ohm terminating resistor from the sweep generator and connect its output to the AMPL INPUT jack. The scope now shows the response curve of the entire amplifier.

   b. Further attenuate the generator outputs and adjust L111 for cut-off at 35 MC and L110 for the flattest over-all response.

7. Make a final adjustment of all coils if necessary. L111, 113, 115 & 117 control the cut-off frequency and L110, 112, 114 & 116 control the mid range. The response curve should be made flat within ±1.5 db from 2 to 35 MC. A typical response curve is shown in figure 2.

Meter Adjustment

1. Inject a 2 MC signal at the AMPL INPUT jack and adjust its level until the signal at the OUTPUT jack is 0.1 volts into a 100 ohm load as measured with a dependable indicating device.

2. Rotate the meter adjustment potentiometer until the meter reads 65 microamperes. (This potentiometer control is located on the top side of the chassis near V105).

Broadband Amplifier Gain Test.

Inject a 35 MC signal at the AMPL INPUT jack and adjust its level until the output meter reads 65 microamperes. Measure the input signal level. It will be less than 2.5 mv if the amplifier gain is adequate. If the level is higher than this the amplifier is probably mis-aligned or some tubes are defective.

Alignment of Multiplier Circuits

1. Inject the 1MC signal from the basic frequency meter at the 1 MC INPUT jack.
2. Connect a microammeter between test point E101 and the chassis ground. Adjust L101 for a maximum meter reading. The meter should read about 155 μa.
3. Move the meter to E102 and adjust L102 and L103 for a maximum reading. The meter should read about 25 μa.
4. Move the meter to E103 and adjust L104 and L105 for a maximum reading. The meter should read about 75 μa.
5. Measure the 10MC signal at Pin A3 of J104 with a VTVM and diode probe. If the reading is not within 10% of 1.2 volts, remove the shield from L105 and re-position the single-turn pick-up loop L106) to bring the reading within these limits. Then re-adjust L105 as described in step 4.
6. Observe the 30 MC signal at Pin A2 of J104 with a VTVM and diode probe. Adjust L107 and L108 for a maximum meter reading. If the maximum is not within 10% of 1.2 volts, remove the shield from L108 and re-position the single-turn pick-up loop (L109) to bring the reading within these limits. Then, re-adjust L108 for a maximum.

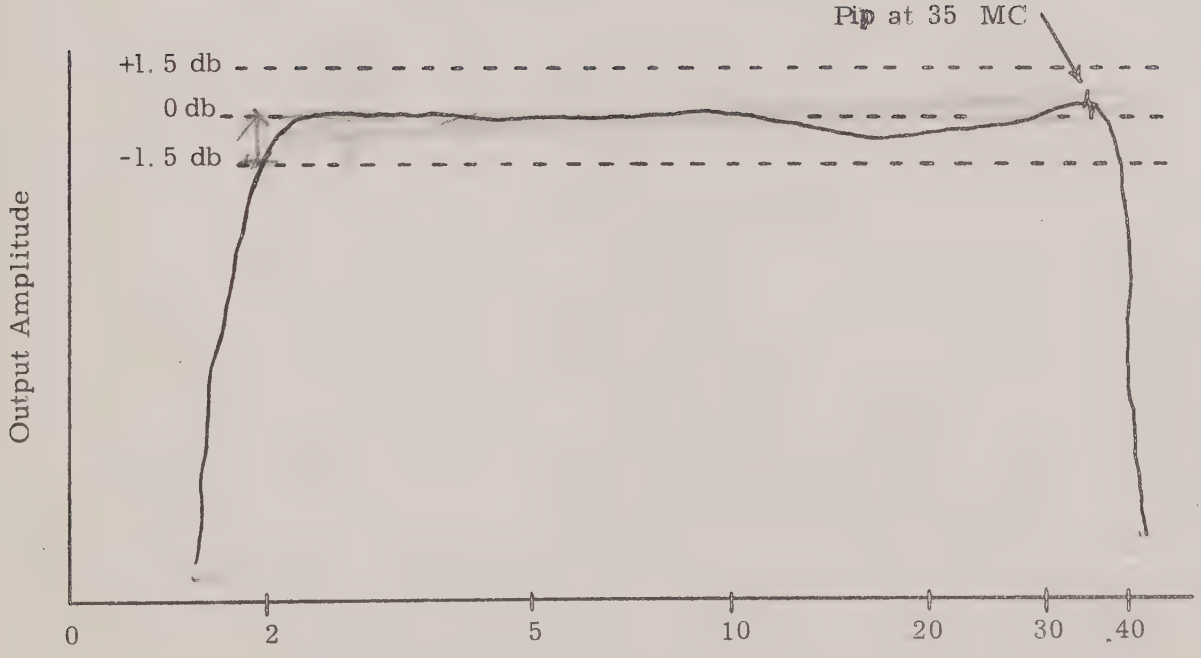
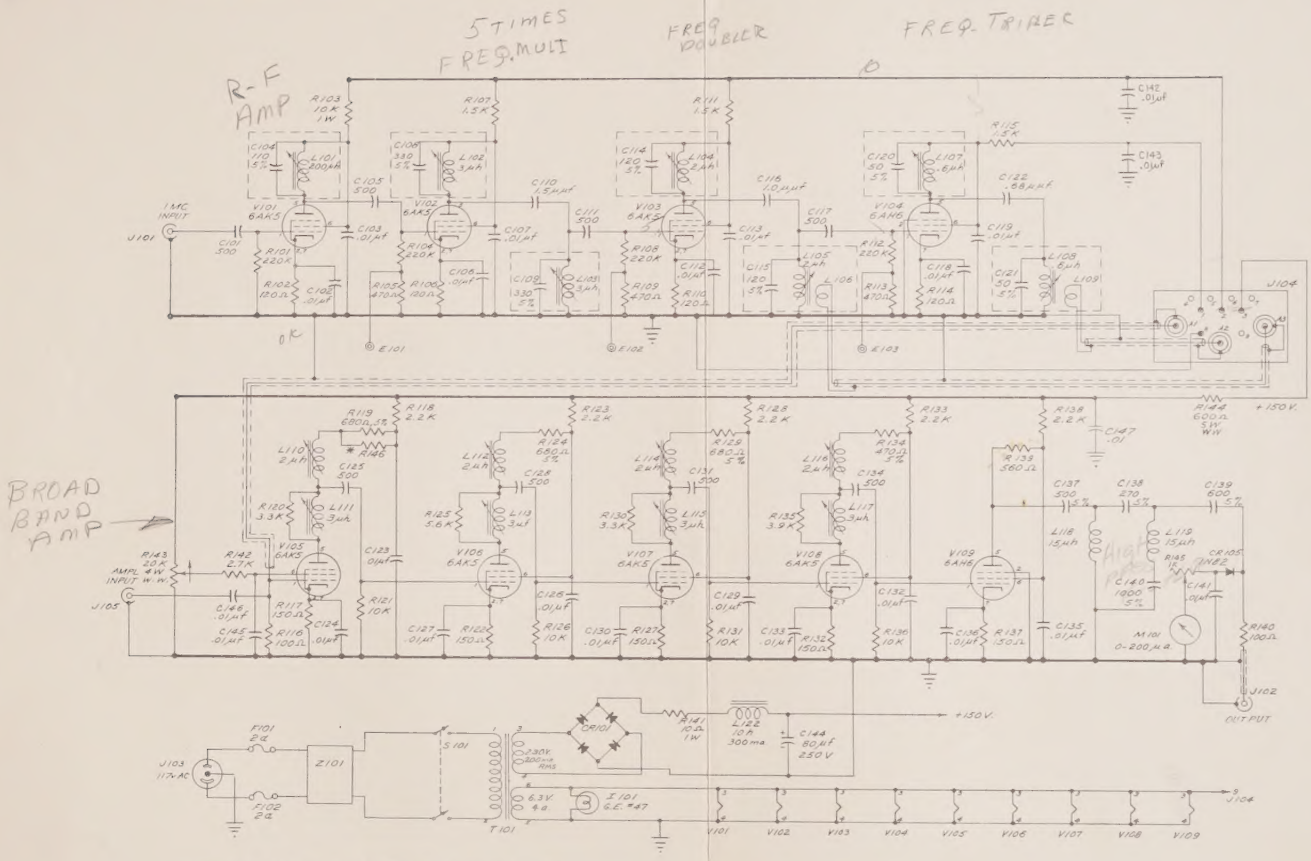


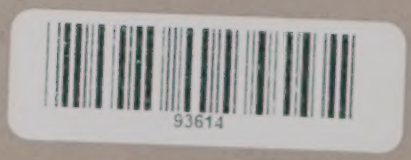
FIGURE 2 TYPICAL FREQUENCY RESPONSE CURVE



ALL RESISTORS ½ W, 10%, CARBON UNLESS OTHERWISE NOTED.
ALL CAPACITORS WITH VALUES GREATER THAN ONE ARE IN μμf, 20%, 500V, UNLESS OTHERWISE NOTED.
ALL CAPACITORS IN μf ARE −20%, +80%, UNLESS OTHERWISE NOTED.
*-R146 FACTORY SELECTED

MODEL 5580 REFERENCE GENERATOR
SCHEMATIC DIAGRAM
DWG. NO. 5580 C 1

January 1959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